Particulate Matter Management in the San Francisco Bay Area

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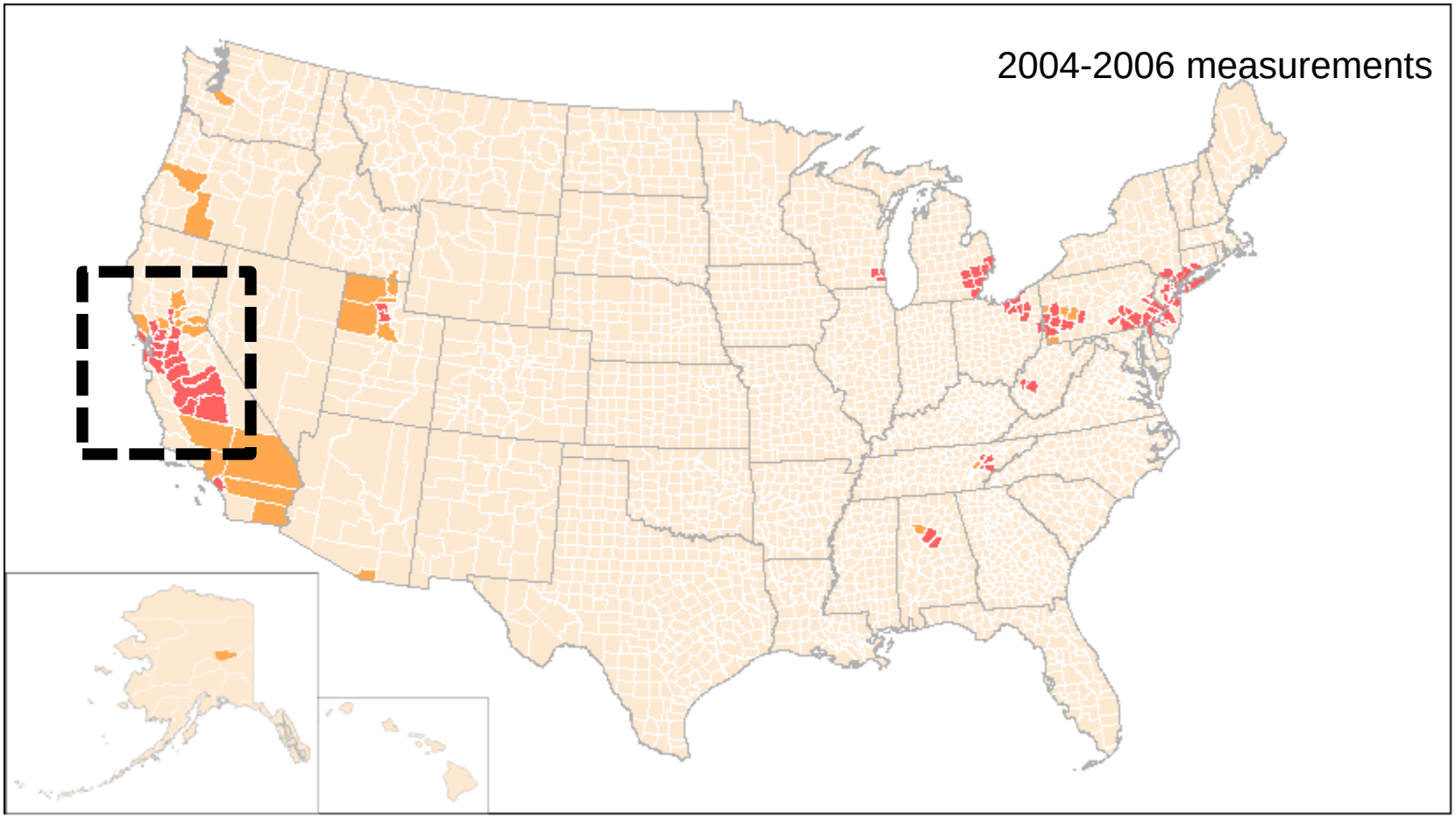
Fine Particulate Matter (PM2.5) Nonattainment Areas in US for 24-hour Standard (35µg/m3)



SFBA attains annual PM2.5 and PM10 standards.

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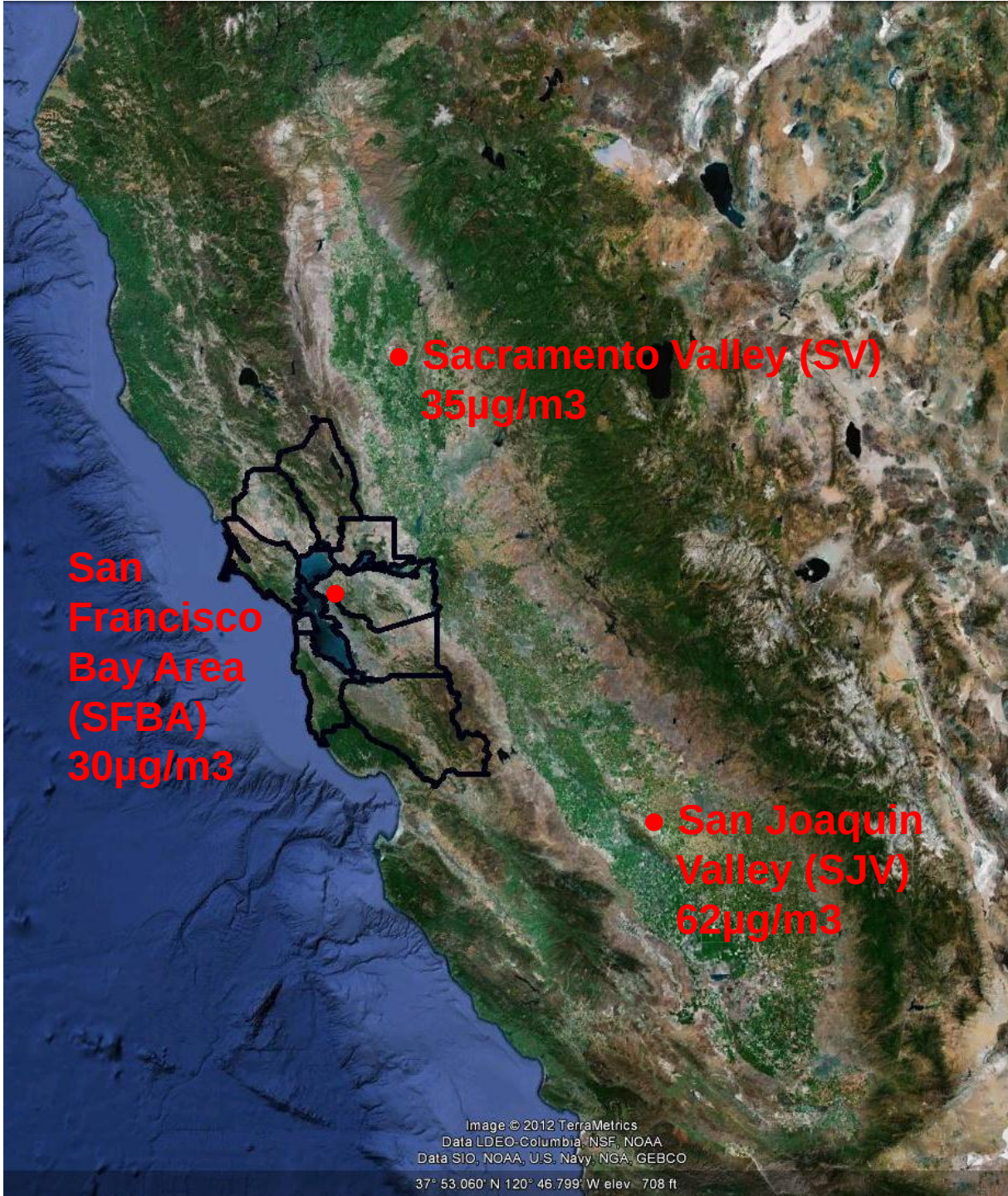
2009-11 24-hour PM2.5 Concentrations in Central California

Unique emissions in Central California

SFBA - industrial, shipping, ports, refineries
SV - residential wood burning
SJV - agricultural and dairy farming



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SFBA Public Health Benefits (per year)
Estimated with US EPA BenMAP

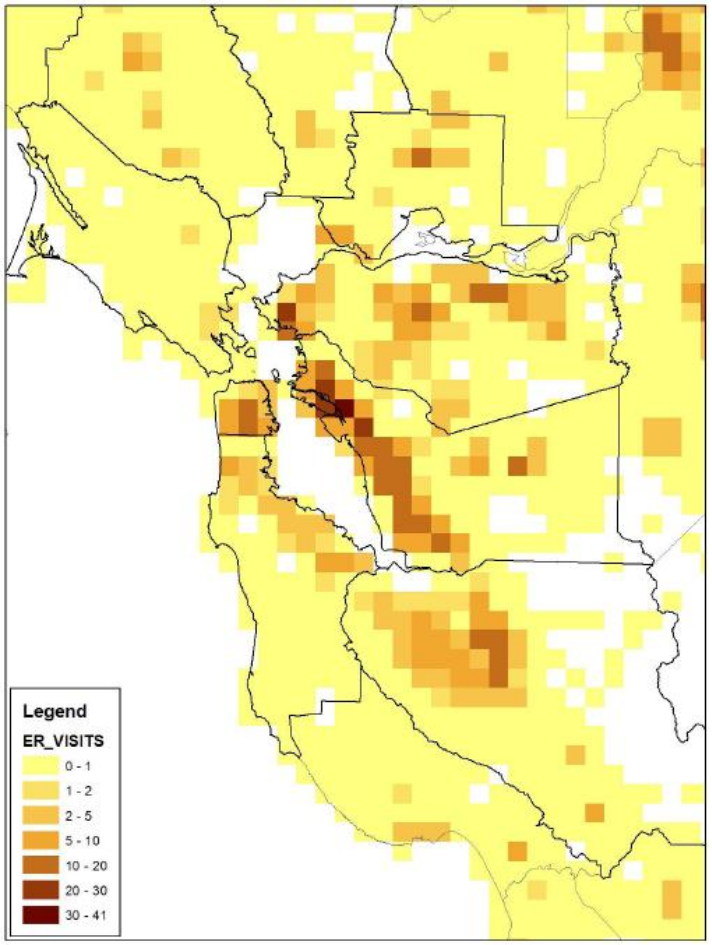
Reducing ambient PM levels by 1 μg/m^3

Health Endpoint Group	Total Incidents Reduced
Mortality (all causes)	66
Chronic bronchitis	61
Acute myocardial infarction (nonfatal)	71
Hospital admissions, respiratory	19
Hospital admissions, cardiovascular	29
Emergency room visits, respiratory	46
Acute bronchitis	117
Lower respiratory symptoms	1,493
Upper respiratory symptoms	1,126
Acute respiratory symptoms	68,348
Work loss days	11,530
Asthma exacerbation	1,362

Estimated health benefits are based on 2010 PM2.5 levels.

Population is about 7.2 million.

Reducing emissions to "background" levels

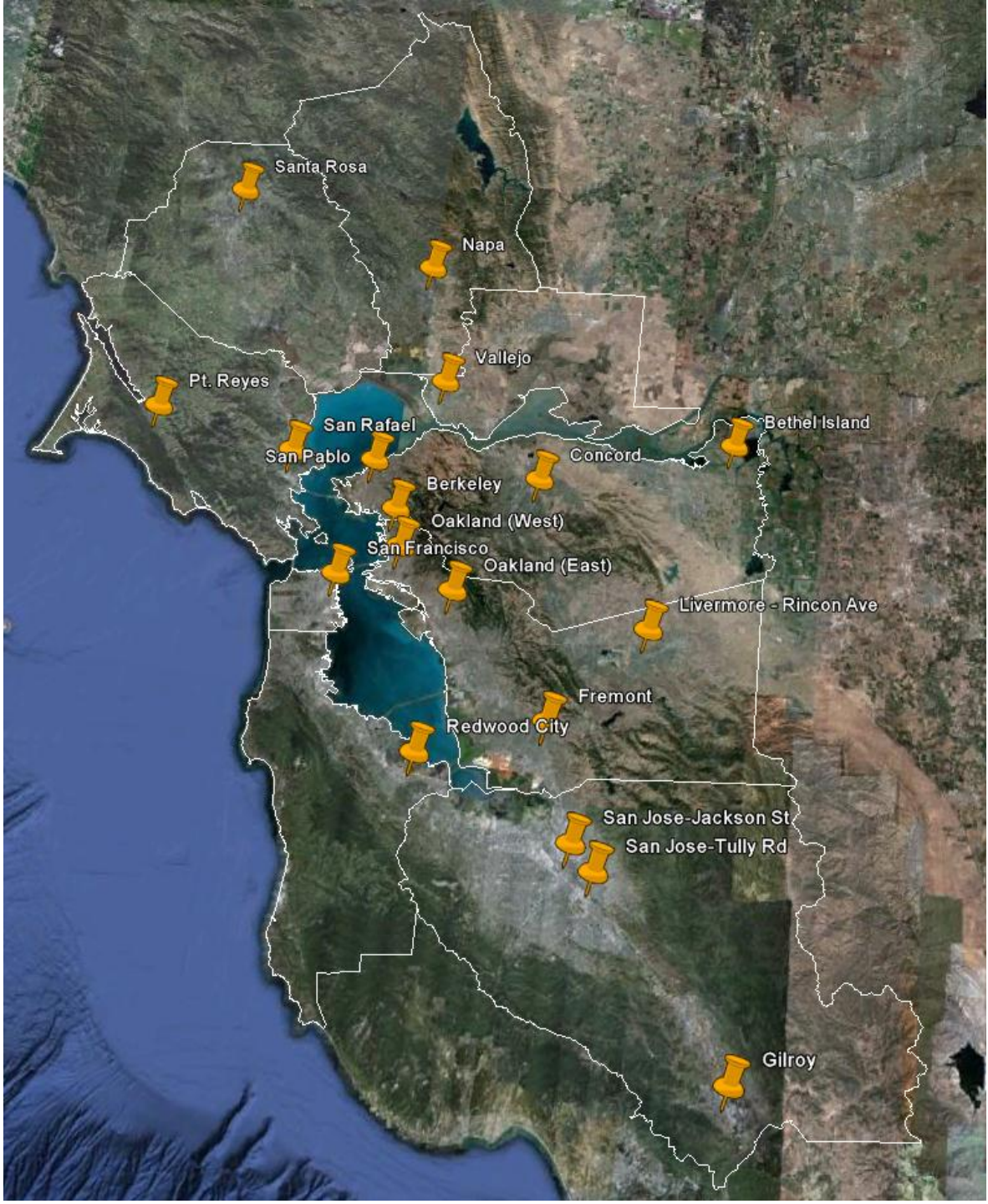


Reduced number of asthma-related emergency room visits per 10k population under 18 years.

SFBA PM2.5 Management Program

- Ambient measurements started in 1999
  - 18 stations (4 are speciation measurement stations)
- Data analysis
  - Statistical analyses to identify weather conditions leading to elevated PM levels; daily air quality forecasting
  - Chemical mass balance (CMB) analysis to identify major PM sources
  - C14 analysis to identify age of organic carbons in ambient PM
- Emissions inventory development
- Air quality modeling
- Emission control programs and rules

SFBA PM2.5 Monitoring Stations



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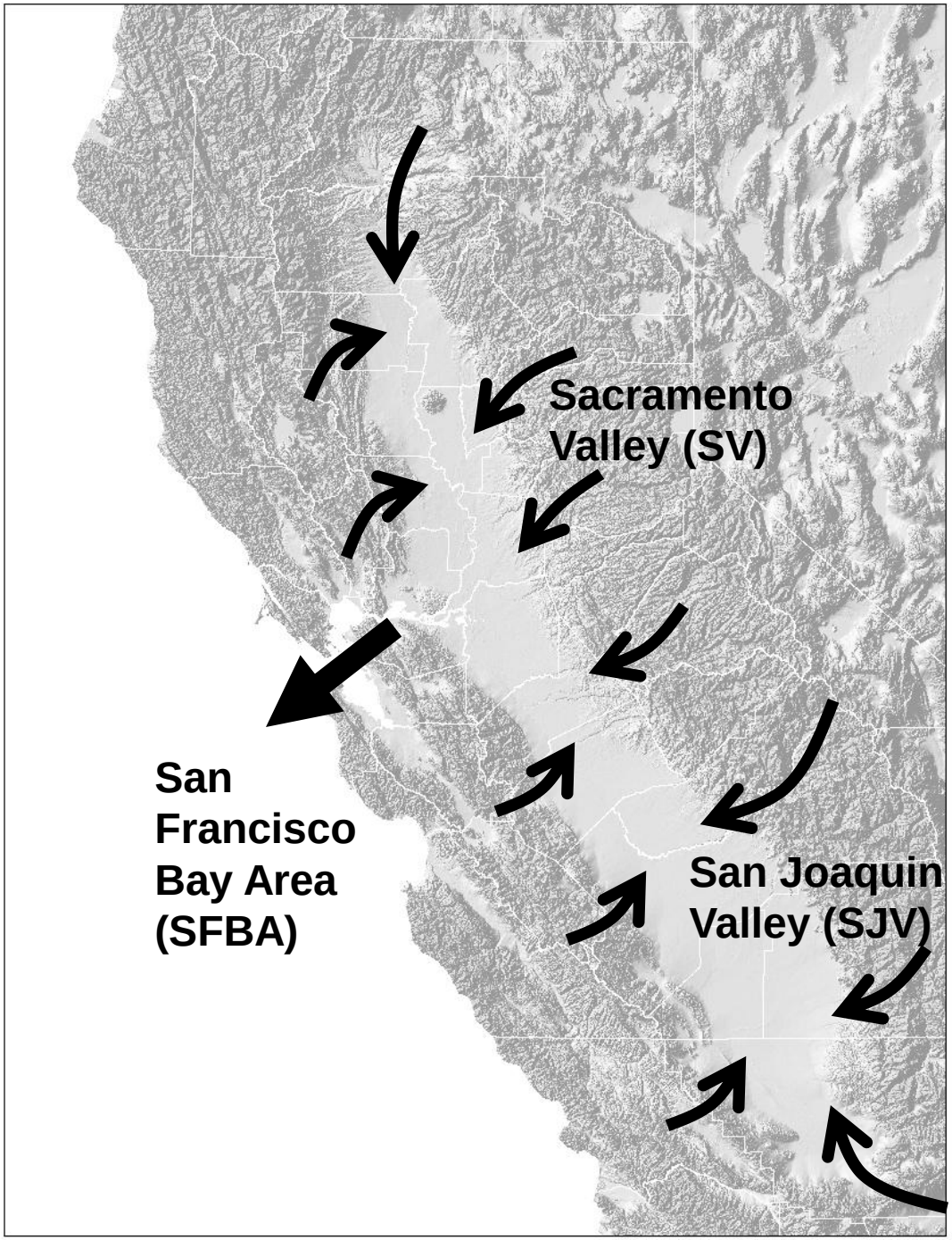
Central California Episodic Winter Wind Conditions: Conceptual Description

- Persistent drainage airflow off valley rims
- SFBA surface flows from inland



Seoul Area Episodic Winter Wind Conditions: Conceptual Description

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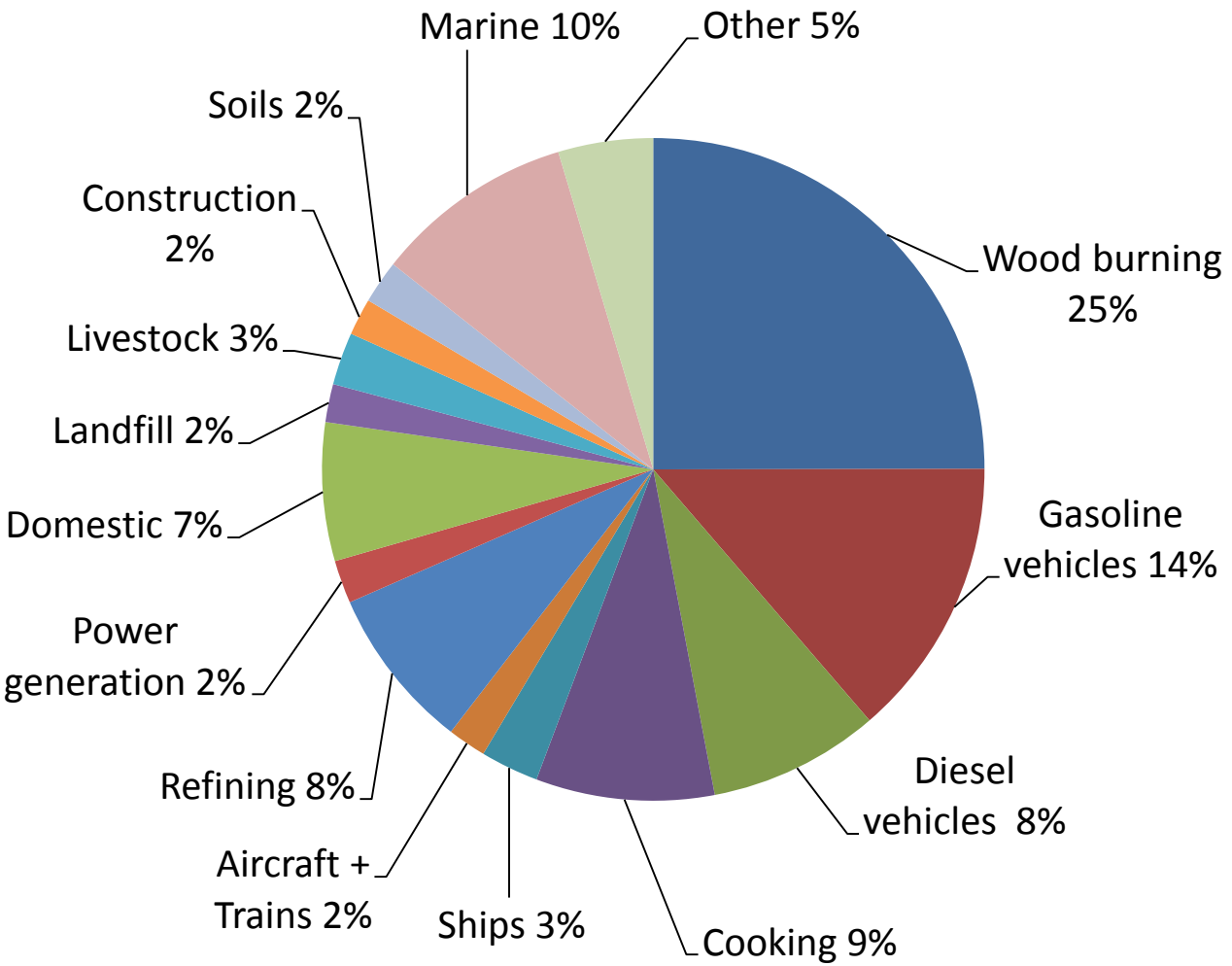
Prepared based on limited information.

SFBA Annual Average PM2.5 Emissions



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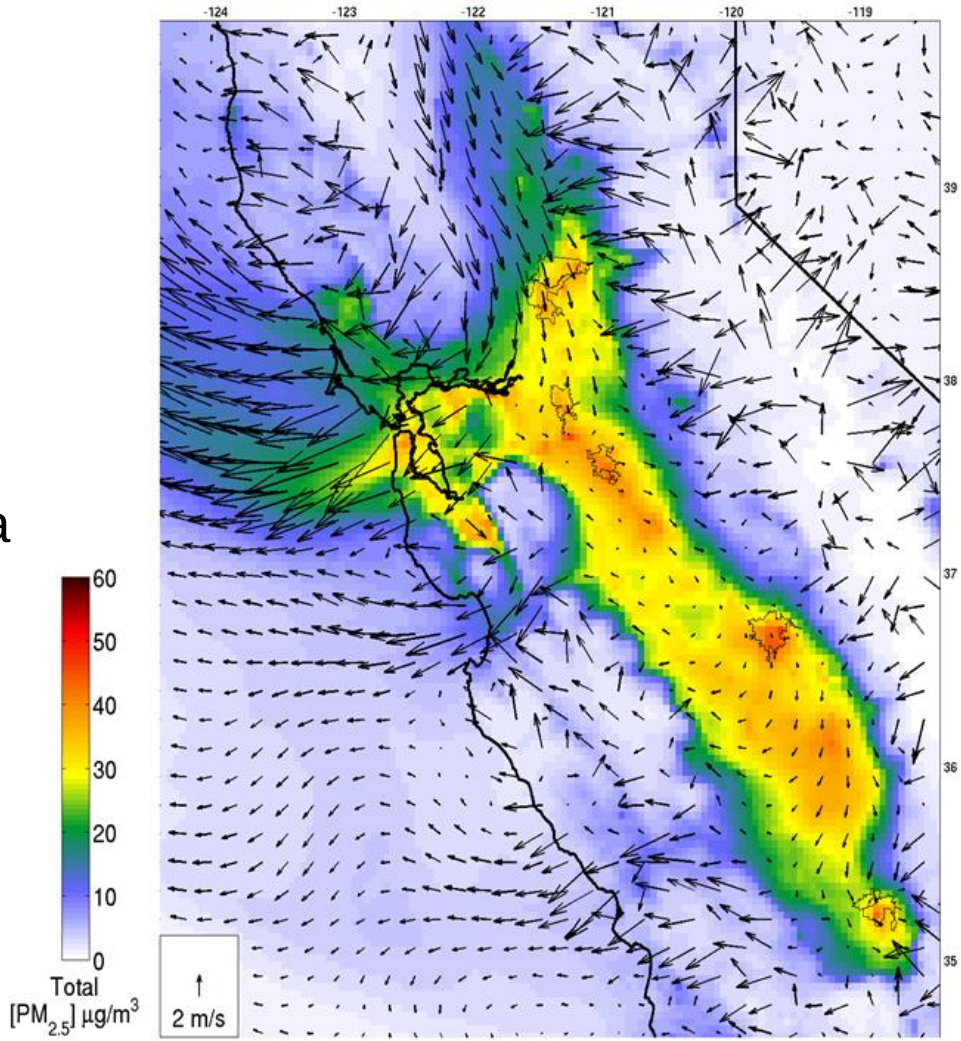
Based on CMB analysis and actual emissions inventory.

PM2.5 Simulations

- MM5 and WRF meteorological models
  - Fine grid resolution
  - Various physics options & initialization schemes tested
- SMOKE processed emissions
  - Developed inventories for wood smoke and unregulated ammonia for SFBA
- CMAQ air quality model



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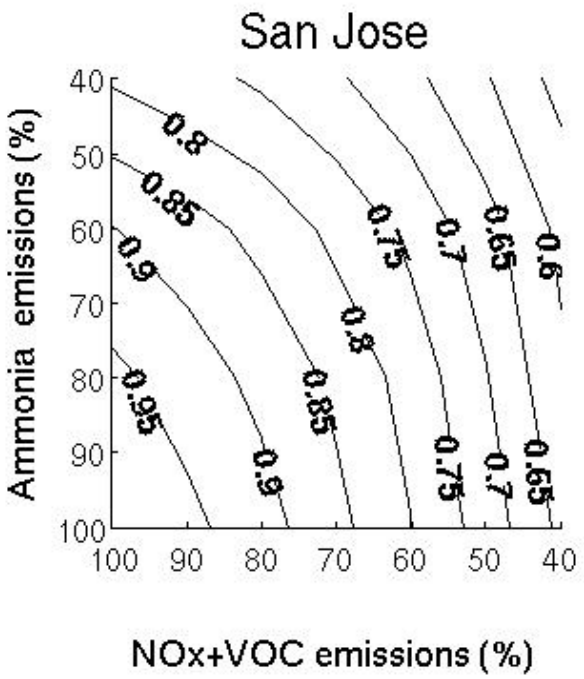
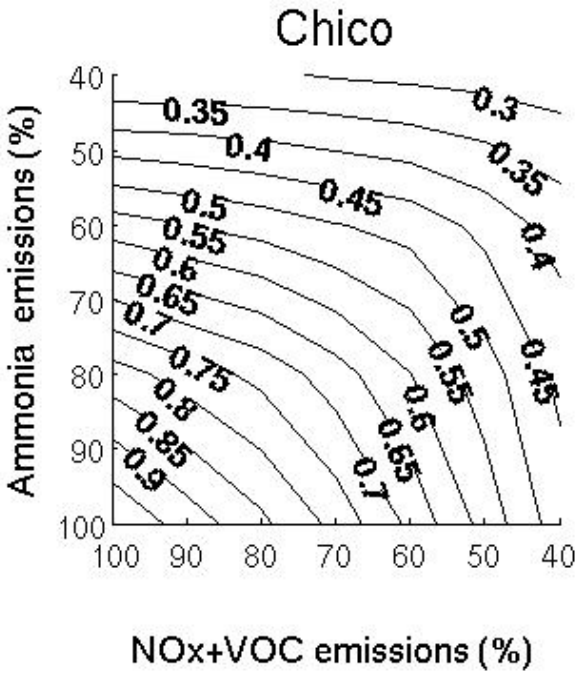
Evaluating Emissions Controls with CMAQ

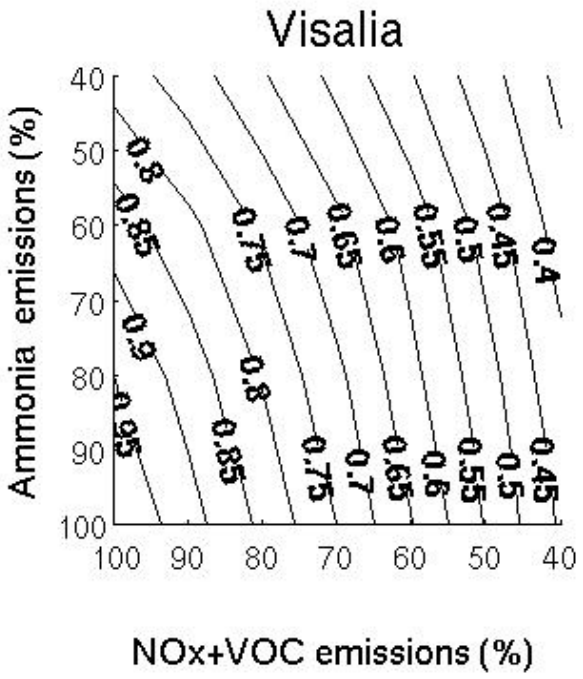
SFBA



SV



SJV



Secondary PM2.5 Response

Primary PM2.5 response, not shown, is linear.

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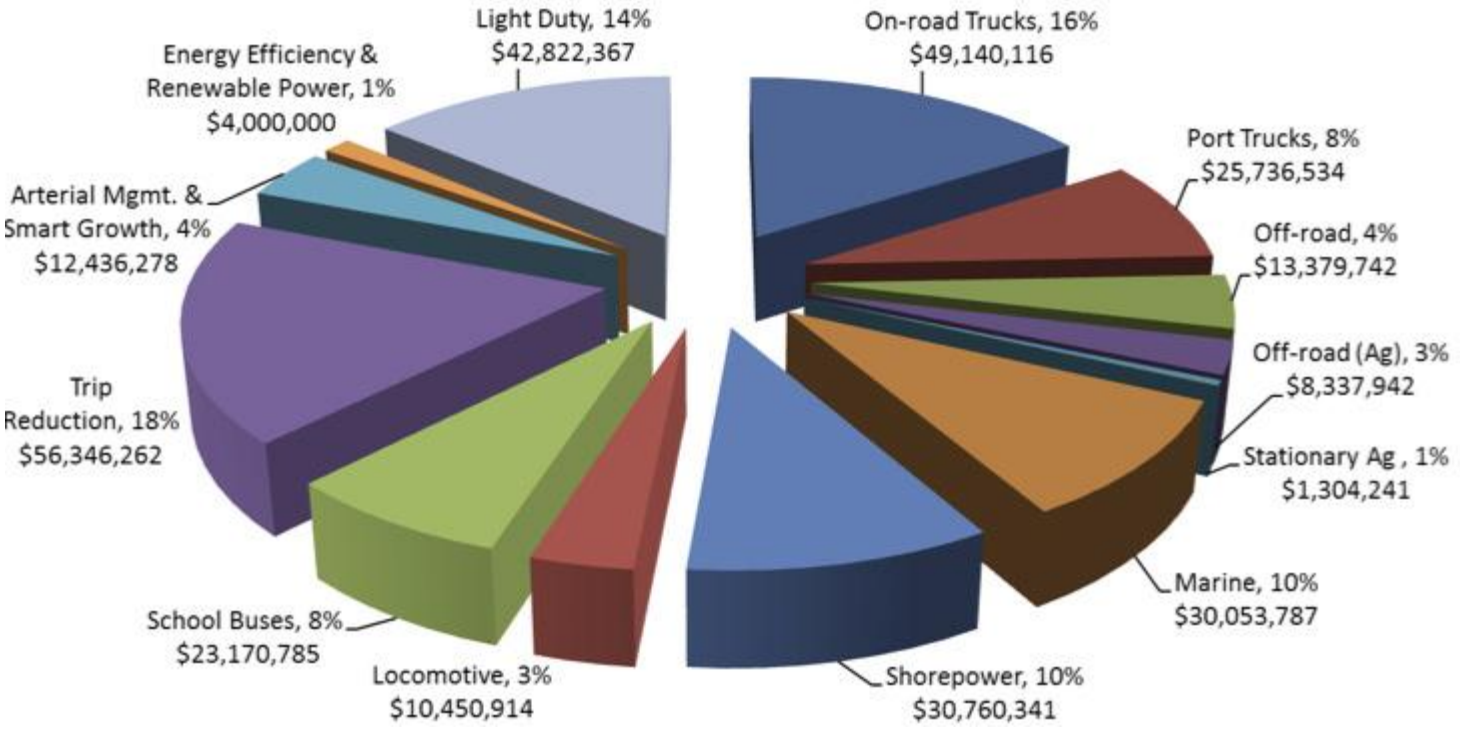
BAAQMD Grants Awarded by Project Type from 2007 to 2011 to Reduce PM Pollution Total = $308 million



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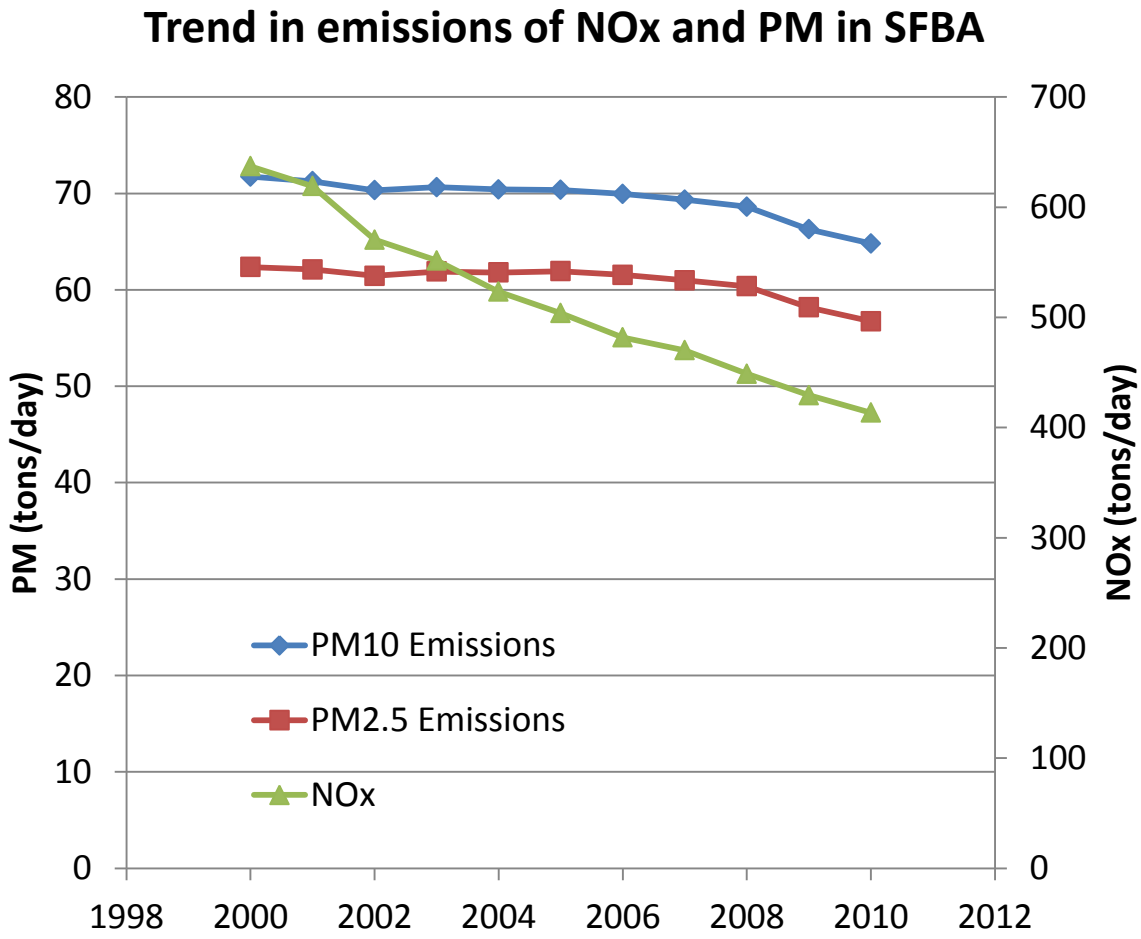
Additional information is available in BAAQMD 2012 PM Plan.



Significant PM reductions due to restriction in residential wood burning (2008-present). Some reductions may be due to ongoing economical recession.

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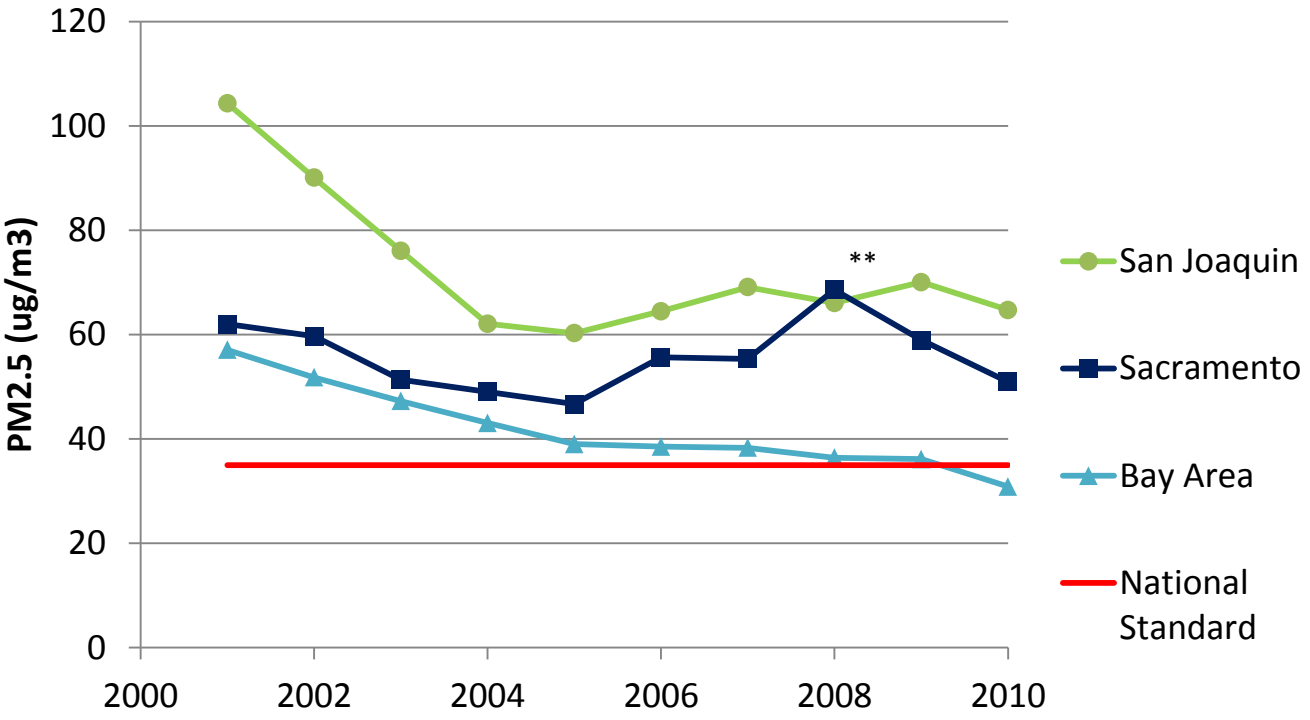
Design Values for 24-Hour PM2.5 Standard for 3 Central California Air Basins



Design values are 3-year averages of 98th percentiles.
**Values for 2008-2010 influenced by wildfires in summer 2008.

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Summary and Future Work

- Monitoring and analyses are important for understanding PM formation and assessing contributions of individual sources
- Benefits of emission controls can be unique to subregions
  - Additional rules and enforcement will continue
  - New and innovative technologies will be developed for further emission reductions
  - Education will continue on how to:
    - Reduce emissions
    - Reduce exposure
  - PM may be monitored from satellites
  - Ultrafine particulate matter will be included in our study

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